

Managing Project Risks

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Software Process Improvement (SPI) Project

Purpose and Objectives

- **Purpose:** To provide an overview of risk management activities that should be performed for a software development project
- **Objective - After this class you should understand:**
 - What a risk is
 - What the Risk Management activities are
 - How to plan for risk management
 - How to identify risks
 - How to define the risk parameters for each risk
 - How to monitor and reporting on risk status
 - What risk management records should be kept

Just a Note About Risk Training ...

- **There is a HQ-provided 3-day class on Continuous Risk Management**
 - **Check for the Continuous Risk Management class on NASA's System for Administration, Training, and Educational Resources (SATERN)**
- **This session will provide only a *very* high-level view of what you should be doing on your software project for risk management**

What is a Risk?

- A risk is any *plausible* event that *could* prevent your project from reaching its goals
 - Any plausible event: A potential problem that might realistically occur and that you should worry about
 - That could prevent you from reaching the goal: Something that, if it happened, would make it difficult or impossible for you meet project commitments

The Risk Management Requirement

- **NPR 7150.2 requirement 86:**
 - **The project shall identify, analyze, plan, track, control, communicate, and document software risks (potential issues, hazards, threats, and vulnerabilities) in accordance with NPR 7120.5**

Why You Should Do Risk Management

- **Because nobody likes surprises (surprises are usually unpleasant)**
- **Because the earlier you acknowledge a potential problem, the better you can deal with it**
- **Because the more you know about a potential problem, the better you can deal with it**

... and if those aren't enough reasons for you, remember that it's an NPR 7150.2 requirement!

The Risk Management Activities

- **Plan your risk management strategy**
 - Identify your initial risks
- **Identify the risks that threaten your project**
 - Identify individual risks
 - Define the risk parameters for each
 - Develop mitigation strategies and plans
- **Monitor and report on risk status as the risk parameters and conditions change**
- **Keep risk management records throughout the project**

Perform these activities in accordance with a defined process, using a Risk Management tool

Plan the Risk Management Strategy

Planning for Risk Management, Part 1

- You need to develop your Risk Strategy, covering:
 - Who is responsible for risk management activities
 - How risks will be identified and classified
 - When to elevate a risk to higher management visibility
 - When a Risk Mitigation Plan is required
 - How risks will be tracked and reviewed
- The Risk Strategy should be documented in your Software Management Plan (SMP) or Product Plan (PP)
- But don't panic!
 - The SPI team has developed appropriate approaches (and even the words) and documented them in the **Software Management Plan/Product Plan Boilerplate Tool***
 - The Risk Management Sections of the SMP Boilerplate and Flight Software (FSW) Product Plan Template provide a complete and compliant strategy
 - Using this is highly recommended! It will avoid problems.
 - If you already have a plan with a Risk Section, review the boilerplate to make sure you have everything covered

* Available to Civil Servants at <http://software.gsfc.nasa.gov/tools.cfm>

Planning for Risk Management, Part 2

- **Brainstorm your initial set of risks as part of your project planning – this is called Risk Identification**
- **For acquisition projects, focus on risks to your acquisition activities, not just the suppliers' risks**
- **Analyze your risks (define the parameters)**
- **Record the initial set of risks in 3 places:**
 - **In the Risk Section of your SMP/PP – a static snapshot**
 - **In your initial BOE – a static snapshot**
 - **Include the cost of any mitigation plans in this estimate**
 - **In a Risk Management Tool**

Your Risks Versus Higher-Level Risks

- If you are part of a larger Project, that Project probably has a Risk Management Tool
 - Risks on your effort that might affect that Project's budget/schedule should be elevated to that Project level
 - That Project will put them in a Risk Management Tool
- But you need to do your own risk tracking separately
 - The High-level Project tends to care about “big ticket” risks that affect its budget or schedule
 - Most of your risks are probably below their radar
 - Some of your risks may be internal risks that you don't want in front of the High-level Project
 - But you still need to track your risks and you should have your own tool to do it

Team-Level Risk Management Tools

- So what tool do you use for your risk tracking?
- SPI has developed a **Risk Management Tool*** that
 - Is based on NASA Continuous Risk Management principles
 - Records initial risks
 - Maintains status as conditions change
 - Provides management reports
 - Automates some of the work
 - Has an embedded Users Guide
- Code 582 teams use the on-line **FSB Risk Management Tool****
 - It provides the above capabilities tailored specifically for Flight Software
 - It is light-weight but flight-tested

* SPI risk tool can be found at <http://software.gsfc.nasa.gov/tools.cfm>

** FSB risk tool can be found at <http://fsb.gsfc.nasa.gov/RM/>

Identify Risks and Define Risk Parameters

Identifying Project Risks

- **Periodically you should:**
 - **Think about the things that could happen on your project that would impact your ability to complete successfully**
 - **For “low-level” risks, think about whether there is a “higher-level” risk that can be defined**
 - **Put those that seem “realistic” into your risk list and put the others in your own separate worry list for later assessment**

Defining Risks

- You need to specify two main parts of a risk: a condition, and a consequence
 - Condition: the event that might happen
 - Consequence: the effect on the project if it does
 - Often phrased as: “If condition, then consequence”
- Examples:
 - If *the simulator doesn't arrive on time*, then *the start of testing will be delayed*
 - We were promised staff coming off project x, but project x has been delayed. If *we don't get the promised staff*, then *we may not meet our schedule commitments*

But There's More to Defining a Risk

- **The condition and consequence are the most important pieces, but there are other important parameters:**
 - **Probability of occurrence**
 - **Potential impact on the project**
 - **Time-frame in which the risk might occur**
 - **And a host of others that we'll talk about later**
- **These parameters are important as you analyze and manage your risks**

Entering a Risk in the SPI Tool

Risk Detail Sheet

		Project: ABC	Report Date: 01/01/06	
Risk ID:	1	<Risk Title>	State:	Research
Identified:	<Date>	G	Rank:	1
Originator:	<Name>	(Exposure (calculated)) ▲	Source:	Tech
Assigned To:	<Name>		Category:	Mgmt
Probability:	Low		Visibility:	Internal
Impact:	Low	Trend ▼	Reviewed:	<Date>
Timeframe:	1-3 mo	New	Modified:	<Date>
	Condition:	Because of the complexity of the varied instrument interfaces to be accommodated		
	Consequence:	The team could miss some specific interface details, causing problems during interface testing.		
	Context:	The mission includes three instruments and one tech demo experiment. Because each instrument has heritage, there are seven unique interface protocols to deal with in the xyz software. While each protocol is fairly simple by itself, considered all together, the combination is very complicated.		
	Status:			
		July 2006 - All ICDs were approved.		
		June 2006 - The Instrument Manager code is being prototyped in Build 2. Interface tests with instrument breadboards/ETUs will begin in September.		
Assigned To	Step Number	Mitigation Step Description / Status	Planned	Actual
<name>	1	Description of Step 1	<date>	<date>
<name>	2	Description of Step 2	<date>	<date>
<name>	3	Description of Step 3	<date>	<date>
<name>	4	Description of Step 4	<date>	<date>

Risk Parameters, 1 of 4

- **Risk Title:** a short, descriptive identifier for the risk
- **Risk Condition:** a phrase describing the condition that could affect your effort (“if”)
- **Risk Consequence:** a phrase describing the risk what might happen if the condition occurs (“then”)
- **Risk Context:** background information to put the risk into context
- **Risk ID, Identification Date, and Originator:** a risk identification number, plus information on when and by whom the risk was identified

Risk Parameters, 2 of 4

- **Assigned To:** the person responsible for tracking and mitigating the risk
- **Risk Probability:** the likelihood of the risk actually occurring
- **Risk Impact:** a description of how serious the consequences of this risk would be
- **Risk Exposure:** calculated by the tool based on probability and impact as red, yellow, or green
- **Risk Timeframe:** how soon this risk would become a problem if nothing is done - short, medium, or long term
- **Risk State:** current state of the risk

		I M P A C T				
		VL	L	M	H	VH
P R O B	VH					
	H					
	M					
	L					
	VL					

Research - The risk has been identified, but no decision has been made as to what to do about it (this is the default state, and probably appropriate for most new risks).
Accept - The risk is a concern, but there are no available mitigation actions.
Watch - The risk is a concern, but no mitigation steps need to be taken at this time; a mitigation plan should be established if the risk has a high exposure or if the timeframe is within 3 months.
Mitigate - The mitigation steps defined for this risk are being taken.
Retired - The risk is no longer an issue.

Risk Parameters, 3 of 4

- **Risk Source:** things that give rise to risks – the default SPI list is
 - technology, external, cost, schedule, requirements, process, resources
- **Risk Category:** convenient "bins" in which to place and count risks – the default SPI list is
 - management, technical
- **Risk Visibility:** an indicator of whether this risk is handled within the project or elevated to management
- **Date Reviewed and Date Modified:** date the risk was last reviewed and modified

- **Risk Trend:** an indicator of whether the risk is improving or worsening
- **Risk Mitigation Plan:** a set of steps designed to reduce a risk probability or impact (details later...)
- **Risk Status:** the space where you keep notes of risk status and any events that affect this risk (with a date)
 - This shows that risks are tracked on a regular basis
- **Risk Rank:** a mechanism to prioritize the order of addressing risks when multiple risks have the same exposure

SPI Risk Management Tool – User Guide Examples

1	Tool Layout and Set-Up
	There are two worksheets in this tool -- the Risk Details Sheet and the Summary Sheet.
	Risk Details Sheet
	Enter the short name of your project on the Risk Details Sheet in cell D2.
	Enter the date of your reports into cell F2 of the Risk Details Sheet.
	Summary Sheet
	The Summary Sheet provides a summary of the risks on your project. All information on this sheet is automatically generated by the tool based on data entry in the Risk Details Sheet. DO NOT ENTER ANY DATA ON THE SUMMARY SHEET. DO NOT SORT THE SUMMARY SHEET.
2	Entering Risks
	The Risk Details Sheet contains a set of entries for each risk; each set being outlined by a thick black border.
	There are several fields that require dates. You must enter a valid date (MM/DD/YY) or treat the field as a text field. Care should be used in entering dates so that they are accurate.
	The following sections of this User's Guide describe each required entry for each risk.
	Risk ID:
	The tool numbers the risks consecutively from 1 to 30. If you prefer a different identification scheme, use this area to input your identifiers.
	Risk Title:
	Replace the text <Risk Title> with a short title for the risk. The short title is used on the Summary Report as a way to quickly describe the risk. The short title needs to convey information to allow someone to decide whether or not to look at the details of the risk.

Impact:			
Impact describes how serious the consequences of this risk would be if it actually happened. Select an impact value from the drop-down list. (Note - the Technical, Schedule, Cost categories do not all have to be present - any one is sufficient. For example, the Impact is High if any of the high Technical, Schedule or Cost categories apply):			
Impact	Technical	Schedule	Cost
Very high	Loss of life, vehicle, spacecraft, or cannot meet minimum mission or technical success/exit criteria.	Impact to critical path and cannot meet major milestone.	Causes major cost impact and requires additional budget resources from another source.
High	Major impact to full mission or technical success criteria but still meets minimum mission success/exit criteria, threatens established margins.	Significant impact to critical path and cannot meet established lower level milestone.	Causes cost impact and may exceed allocated reserves and may require resources from another source.
Moderate	Moderate impact to full mission or technical success/exit criteria, but can handle within established margins.	Impact to critical path, but can handle within schedule reserve; no impact to milestones.	Causes cost impact and use of allocated reserves.
Low	Minor impact to full mission or technical success/exit criteria, but can handle within established margins.	Minor schedule impact, but can handle within schedule reserve; no impact to critical path.	Minor impact, but can be handled within available reserves.
Very low	Minor or no impact to full mission or technical success/exit criteria or margins.	Minimal or no schedule impact, but can handle within schedule reserve; no impact to critical path.	Minimal or no cost impact or increase over that allocated and can be handled within available reserves.

Creating Risk Mitigation Plans

- Risk Mitigation Plans can be very simple, or quite involved
- Risk Mitigations are not free – usually some resources (hours/\$) involved
- Two types of risks:
 - Internal: can be handled within existing resources
 - Elevated: need resources from Project
- Risk Mitigation Plans for internal risks:
 - Provide a list of mitigation steps, assignee, and due date (e.g., collect regular status on the risk or conduct resolution meetings with stakeholders)
 - State “no cost or schedule impact”
- Risk Mitigation Plans for elevated risks:
 - Identify mitigation steps, then assignee, estimated cost, and schedule for each step
 - Mitigation plan must be approved and funded by the Project if it is to be implemented

Monitor and Report on Risk Status

- **Review risks for changes on a regular basis (at least monthly):**
 - Any new risks to enter?
 - Have any risk conditions changed?
 - Do we need to kick off a mitigation plan?
 - Any new status to report?
 - Do we need to elevate a risk to the Project?
 - Have any risks retired?
- **Update the parameters in the Risk Management Tool**

- **Report risk status in your management Status Review (BSR):**
 - Provide a Risk Summary page (both tools provide this)
 - Provide a Detail page for any new risks or high exposure (red) risks
- **Report risk status in each milestone review**
 - Include retired risks

Risk Reporting - Spreadsheet Tool

Project: ABC

Report Date: 01/01/06

Trend	Probability	Impact				
		VL	L	M	H	VH
	VH	0	0	0	0	0
	H	0	0	0	0	1
	M	1	0	0	1	0
	L	0	0	1	0	0
	VL	0	0	0	0	0

I = Improving
 W = Worsening
 U = Unchanged
 N = New

Exposure	New	Modified	Retired	Open
R	0	0	0	1
Y	0	0	0	1
G	2	0	0	2
Totals	2	0	0	4

Risk ID	Rank	Trend	Risk Title	Assigned To	Exposure	Timeframe	State	Identified	Reviewed
1	1	U	My First Risk 1	Donna	Y	1-3 mo	Watch	01/01/07	01/25/07
2	1	N	My Second Risk	Bob	G	1-3 mo	Watch	01/02/07	01/10/07
3	1	W	My Third Risk	Mark	R	<1 mo	Mitigate	01/03/07	01/20/07
4	1	N	Risk 4	Dave	G	> 3 mo	Research	01/04/07	<Date>

Summary

Detail

Risk ID:	1	My First Risk 1	State:	Watch
Identified:	01/01/07	Y	Rank:	1
Originator:	Page	(Exposure (calculated)) ▲	Source:	Tech
Assigned To:	Donna		Category:	Mgmt
Probability:	Medium		Visibility:	Internal
Impact:	High	Trend ▼	Reviewed:	01/25/07
Timeframe:	1-3 mo	Unchanged	Modified:	<Date>
Condition:	Because of the complexity of the varied instrument interfaces to be accommodated			
Consequence:	The team could miss some specific interface details, causing problems during interface testing.			
Context:	The mission includes three instruments and one tech demo experiment. Because each instrument has heritage, there are seven unique interface protocols to deal with in the xyz software. While each protocol is fairly simple by itself, considered all together, the combination is very complicated.			
Status:	July 2006 - All ICDs were approved. June 2006 - The Instrument Manager code is being prototyped in Build 2. Interface tests with instrument breadboards/ETUs will begin in September.			
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<name>	2	Description of Step 2	<date>	<date>
<name>	3	Description of Step 3	<date>	<date>
<name>	4	Description of Step 4	<date>	<date>

Risk Reporting – FSB Tool

		IMPACT				
		VL	L	M	H	VH
P R O B	VH					
	H					
	M			1		
	L			4	1	
	VL					

Exposure	Previous Reporting Period	Current Reporting Period			Total Risks Open
		New	Modified	Retired	
Red	0	0	0	0	0
Yellow	2	0	0	0	2
Green	4	0	0	0	4
Totals	6	0	0	0	6

ID	Rank	Risk Title	Assigned To	EXP	TF	State	Submitted	Modified	Reviewed
16	1	Trouble meeting Mini-RF high data rate	M. Blau	9	M	Research	04/10/07	04/11/07	04/10/07
7	2	High Data Rate from LROC	M. Blau	8	M	Watch	08/19/05	04/11/07	03/06/07
15	3	New cameras added to LRO baseline	Mike Blau	6	M	Research	03/06/07	04/11/07	04/10/07
14	4	DSB delivery is late in the FSW development cycle	Mike Blau	6	M	Watch	06/05/06	04/10/07	03/06/07
13	5	Lack of dedicated ETU for FlatSat	Mike Blau	6	L	Mitigate	06/05/06	04/10/07	03/06/07
3	6	CFDP Class 2 service	M. Blau	6	M	Research	08/19/05	04/10/07	03/22/07

Summary

Detail

ID:	10	IFSW Lab CTP Simulator Fidelity							
Condition:	IF the CTP simulator is delivered with inadequate fidelity to fully test the ISIM-CTP functional and performance interface capabilities								
Consequence:	THEN debugging and troubleshooting during I&T will cause cost growth and potentially impact design of the IFSW.								
Context:	The first time the IFSW and the NGST Developed FSW run together is in ISIM I&T.								
Sources:	Project Constraints				Categories:	Inst. App. Dev. Effort , Verif. & Val. Effort			
Mitigation Step Description/Status						Due Date	Completed	Resp.	
Monitor the SC - ISIM FSW Interface Requirements and the SC Software design to ensure compatibility across systems.						05/31/2008	n/a	Ed Greville	
Risk Status									
5/05 Open - monitoring. Budget constraints may prevent the RR models test - but continue to pursue this as an option for late 2006 timeframe.									
9/05 Status changed to accept and Impact changed to Low. Additional delays in NGST FSW and cost overruns will not permit any add'l testing. Impact of this risk has been accepted by the Project.									

Keeping Risk Management Records

- Snapshot of initial risks in SMP/PP
- Snapshot of initial risks in BOE
- Cost of mitigation plans in BOE
- Risk summary/detail snapshots in BSR presentations and life-cycle reviews
- Minutes of team meetings where risks were discussed
- Any e-mails discussing risks

Risk Management Summary

- You need to identify and track risks:
 - It's a good engineering/management practice
 - It's a Center (and Agency) requirement
- There are tools in the SPI Website that can help you
- Read the User's Guide for the tool you select
- Maintain your risks and risk status
- Report the risk status to your management each month
 - Report to the Customer on Elevated Risks regularly as well
- Keep all of the risk management records in your project repository

Questions?

Acronyms

- **SPI – Software Process Improvement**
- **HQ – Headquarters**
- **SATERN – System for Administration, Training, and Educational Resources**
- **NPR – NASA Procedural Requirement**
- **FSW – Flight Software**
- **FSB – FSW Systems Branch**
- **SMP – Software Management Plan**
- **PP – Product Plan**
- **BOE – Basis of Estimate**
- **BSR – Branch Status Review**